Interview with Dr. Patricia L. Gruber
Office of Naval Research Director of Research


Dr. Patricia Gruber

Dr. Patricia Gruber joined the Office of Naval Research in December 2005 as the Director of Research. She is responsible to the Chief of Naval Research for the oversight of the overall integration of the Discovery and Invention (D&I) science and technology (S&T) portfolio in support of naval mission areas. She has primary responsibility for maintaining a strong D&I portfolio in S&T areas that are of interest to the Navy, providing transition bridges to later stages of development and nurturing academic and naval S&T human capital resources.

Dr. Gruber talked about her work in August during the ONR Naval S&T Partnership Conference.

CHIPS: What is in the D&I research portfolio?

Dr. Gruber: Our portfolio is split into three segments. About 40 percent is the D&I portfolio, otherwise known as basic and early applied research. I have oversight for that portfolio. There are acquisition enablers, which include Future Naval Capabilities (FNCs), 6.3 work, SBIR or Small Business Innovative Research, and Manufacturing Technology, and then the things we call leap-ahead innovations such as Innovative Naval Prototypes and Swampworks.

I get to manage the stuff that is fun. By the time you get to 6.3 funding and the FNCs, which are designed to fulfill enabling capabilities and capability gaps that have been identified by the operational Navy and the acquisition community, they are well-defined.

On the other side, D&I is a broad portfolio. We try to come up with technology options that might be relevant or significantly contribute to FNCs. We might not see some things in D&I basic research pay off for 10 to 20 years, but it is where you can be creative in terms of looking for new ideas.

A typical path is for D&I to transition into an embedded naval prototype or future naval capability and then into a program of record. However, sometimes D&I transitions directly to the fleet, either through licensing of our technologies to commercial products that have been sold to the Navy and Marine Corps or directly in response to urgent operational needs. A good example is QuikClot which is a product we fielded rapidly to stem blood loss on battlefield casualties.

In May the Navy's Strategic Plan came out. It is at the top level where we start to think about what we need to do to support the Navy focus. We are working on our S&T strategy now. We tap a lot into the universities. My primary performers in the D&I portfolio are about 60 percent university, about 30 percent in-house Navy laboratories, and that includes the Naval Research Lab, naval warfare centers and the remainder is industry.

CHIPS: Did the war change the focus for long-term research?

Dr. Gruber: Organizationally, ONR had already made changes that allowed us to focus on the global war on terror, expeditionary warfare and asymmetric warfare. The primary example is that we formed a department specifically focused on expeditionary warfare and the GWOT.

We made a big shift at the end of fiscal year 2004. ONR, under Rear Adm. Cohen, stood up a basic research program for countering IEDs, improvised explosive devices. A lot of the basic research that you see has to do with detecting devices but also trying to move further up the kill chain — and not just defeating the device — but defeating the system by looking at political, cultural and social networks.

Anytime you have asymmetric threats or enemies, the better you understand their mechanisms and networks — and all the pieces in their supply chain — the better off you are. We have seen more of an emphasis on those softer sciences.

CHIPS: Can you describe some of the top research areas?

Dr. Gruber: Battlespace environments research is about the ability to understand and model the environments that the Navy operates in – air, sea, undersea and space. It is also understanding the impact of those environments on the Navy systems that allow us to operate.

Sensors, electronics and electronic warfare have to do with developing the sensors for ISR (intelligence, surveillance and reconnaissance) communications, and electronic warfare for weapons and also self-defense.

Information systems involve getting the right information in a timely fashion to the right person in a form that they can use. It is situation awareness, it is decision making, and it is information fusion. It is a complex field critical to the Navy.

Sea and ground vehicles research involves building platforms that are high-performance, survivable, maintainable and reliable. A key component is power and energy. Not only energy from an affordability perspective but also as we introduce new capabilities. For example, directed-energy weapons on disparate platforms creates new, unique challenges for the power plants on those platforms.

Materials and processes are issues that cut across all the platforms and all the functional areas from vehicle to personnel protection. Corrosion alone costs the Navy about $3 billion in maintenance costs a year. In air platforms, similar to air-ground vehicles, we are looking for more efficiency and affordability. Reduced cost vertical lift is a big issue for operational capability.

Weapons research includes both undersea and airborne weapons.

The ultimate goal is long-range precision targeting with high probability of kill. This arena also includes the emerging directed-energy weapons and weapon countermeasures.

The last couple of areas focus on warfighter performance. Biomedical work tries to improve casualty care and understand the effects of stress, both mental and physical on our troops in tactical environments. We also fund work in undersea medicine to help more safely perform operations underwater.

Human systems research is another area that cuts across all capabilities and is critical. We can and do build the best systems in the world, but they are not useful, if we do not adequately train our personnel in how to use them. This department does a lot of work in how humans learn, how they make decisions, and the neural and cognitive processes associated with them. We are pushing the envelope on training technologies.

CHIPS: I noticed that your degrees are in marine science and oceanography. Are those your primary interests?

Dr. Gruber: I have a real affinity to programs in oceanography and underwater acoustics and marine meteorology. I resonate with those because those are the ones I grasp more intuitively. I also spent time in telecommunications and information technology so I'm interested in information and knowledge systems. My job though is to balance the portfolio across Navy and Marine Corps needs.

I am also fascinated by biomimetics and taking what we can learn from biological systems, Robolobster is an example, and applying it to make more efficient systems that perform better.

CHIPS: You talked about aligning the S&T budget to the POM 08, is there some flexibility there? (See the chart below.)

Dr. Gruber: Because of the types of funding mechanisms that we use, we typically award three-year grants to universities. One of the important outputs of D&I is not just technology, but it is technologists. This is where we are fostering the next generation of scientists and engineers. Hopefully, they will go on to work in the naval enterprises or perform work that is critical to the Navy in the future. In any given year, the research funds that ONR distributes support about 3,000 students, mostly graduate students, but some undergraduate. That is an important resource that we are fostering.

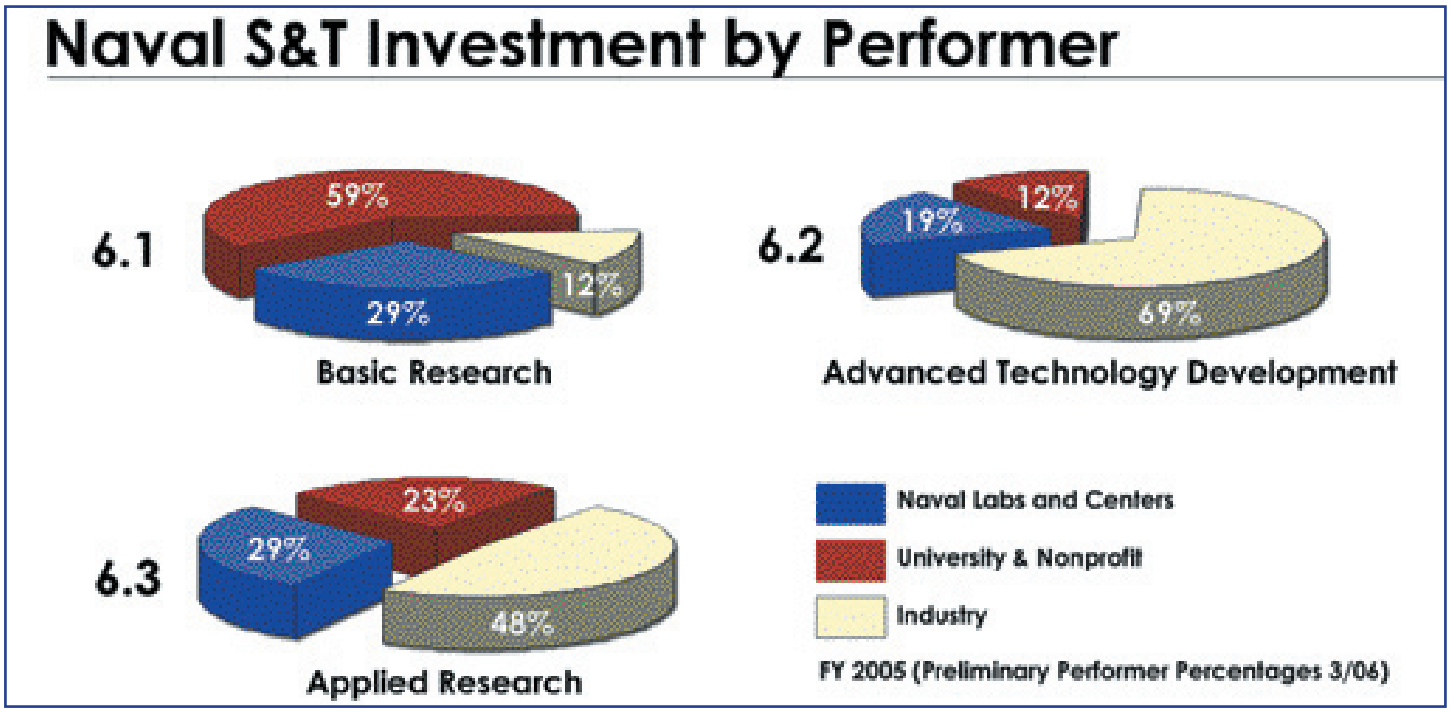
You do not make big shifts in the D&I portfolio in a given year. If you are funding students for a master's or Ph.D., they need to have stable funding. In FNCs, in a given year, 20 to 25 percent of those programs might turn over.

When I say align, I mean that we are trying to communicate what the priorities are to the ONR departments so the program officers making decisions have some strategies and guidelines. There is always more good work than you have money to fund, and you have to make hard decisions.

CHIPS: Your job is complex.

Dr. Gruber: I love it! It is challenging. There are a lot of demands on the Navy. I started my career in the DoD in the late '80s in the Naval Research Lab during the Cold War. If you look at what the Navy is called on to do now versus what they were called on to do then, the number of missions and variety of capabilities and requirements that they have facing them is astonishing.

That puts a lot of demands on S&T to be able to sustain those missions going forward. We in D&I have a long-term horizon and the Navy has a shorter-term horizon because the fleet is operational. That mismatch in expectations is sometimes a problem.



We want to make sure that younger officers coming up through the ranks understand the value of S&T and understand that it is essential to make those long-term investments.

Secretary of the Navy Winter made an interesting comment that we all should be looking at what we are going to need in the future and not just continue to train the same types of people. A good example is information systems. Fifteen or 20 years ago we were not thinking much about hiring people who had expertise in information systems and networking.

CHIPS: In your role, do you engage with warfighters?

Dr. Gruber: My closest ties to the operational fleet are the ONR Global Science Advisors and the warfare centers. The warfare centers understand the S&T. They have the Navy perspective — a unique perspective that I cannot find at universities. The naval warfare centers are a national asset.

CHIPS: Do you have any concerns about the next generation of scientists and engineers?

Dr. Gruber: There is no doubt that we are seeing fewer and fewer American students choosing to go into science and engineering. However, I am an optimist. I think that trend will reverse. Before I came here, I was on campus at Penn State. Even though I did not teach, I interacted with students, and I noticed that students these days are much more savvy consumers than I was when I went to college.

I went into physics because I liked it in high school, and I thought it would be neat. I was not thinking about what kind of job I was going to get or where my job opportunities were going to be. Now students want to know what their return on investment is going to be. In recent history, the opportunity and the dollars have been in business and sports-related fields. It is supply and demand.

At Penn State, I was mentoring a freshman in materials science and I told her to do whatever she could to stay in a technology field. In the not too distant future the baby boomers are going to start retiring, and people are going to be clamoring for young professionals with technical skills. You will see that pendulum start to swing when they realize that there are significant opportunities in science and engineering.

The challenge that the Chief of Naval Research and I have decided to take on with our education and outreach is not to try to solve the problem with the shortage of scientists and engineers in the United States. Instead, we want to get those graduates that are coming out in science and engineering fields to be interested in working on Navy problems or working for the Navy.

We have to inform students about the great career options in science and engineering. I had my Ph.D. funded by ONR, and I went on to work on Navy problems.

Dr. Gruber's biography is available at http://www.onr.navy.mil/about/docs/gruber_patricia_2006.pdf. CHIPS

DNA-Biopolymer Photonics Program

By U.S. Air Force Lt . Col. Torsten Rhode

New and significant contributions have recently been made to the area of bioengineering. Dr. James G. Grote, from the Air Force Research Laboratory (AFRL), has been leading a team from around the world in investigating a new class of polymer, based on DNA derived from natural byproducts of the fish hatchery industry.

Contributions, like those made by researcher Lt. j.g. Kathleen Mandell, Ph.D., through a partnership with the AFRL and the Office of Naval Research Joint Science and Technology Reserve Project, and with the support of Dr. Frances Ligler, senior scientist for biosensors and biomaterials at the Naval Research Laboratory's Center for Bio/Molecular Science and Engineering (CBMSE), have helped the team develop the new biopolymer into a material which possesses unique optical and electromagnetic properties that no other known polymer has.

These include high and tunable conductivity and ultra low optical and microwave loss. Electronic and electro-optic devices fabricated from this new biopolymer have also demonstrated performance that exceeds the performance of the state-of-the-art devices fabricated from current organic-based materials.

Biopolymers may be the "silicon" of tomorrow's polymers, with a potential impact on a wide spectrum of both electronic and optoelectronic devices, while at the same time being inexpensive and easy to process. Where silicon is today's fundamental building block of inorganic electronics and photonics, biopolymers hold promise for tomorrow's fundamental building block for organic electronics and photonics.

This is significant because it demonstrates that biotechnology is not only applicable for genomic sequencing and clinical diagnosis and treatment, but can also have a major impact on non-traditional biotech applications as well, opening up a whole new field for bioengineering. CHIPS

Lt. j.g. Kathleen Mandell conducting tests on a DNA biopolymer specimen.